THE INSTITUTE OF PHYSICS
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BULLETIN

No. 23 *Information in this circular is not intended for general publication: your copy should not therefore be passed to a library.* NOVEMBER 1951

LONDON BRANCH "AT HOME"

The Committee of the London and Home Counties Branch decided to open the present session with an "At Home" in the Institute's House. The response to the preliminary enquiry from members was so heavy that it was decided to hold this event on two nights and, on October 11th and 12th about two hundred members and their ladies attended. They were received by Dr. A. J. Maddock, the Chairman of the Branch, and Mr. W. F. Floyd, Vice-Chairman. A number of demonstrations and exhibits had been arranged and a programme of films was shown. A buffet supper was provided by the Institute's canteen. From the comments which have been received the occasion appears to have been highly successful and much enjoyed by members.

Dr. A. J. Maddock receiving Mrs. E. R. Davies, wife of the Institute's Honorary Treasurer.

Among the group on the left are Dr. E. M. Warren and (back to camera) Mr. G. W. Warren, Mr. and Mrs. N. L. Harris. The group behind includes Mrs. F. Y. Poynton, Dr. and Mrs. H. L. Penman, Mr. (standing) and Mrs. E. van Someren. On the extreme right are Dr. and Mrs. J. C. Chaston.

Miss M. V. Griffiths (left), Mrs. Forrest and Dr. J. S. Forrest (centre), Mr. S. N. Ray, Mr. P. R. Coursey and Mr. G. Parr (right). Behind Mr. Coursey are Mr. H. S. Young and (back to camera) Dr. B. P. Dudding.

Mr. W. F. Floyd (left) and Professor J. D. Bernal.

CONFERENCE ON NATIONAL CERTIFICATES IN APPLIED PHYSICS

About 45 invited representatives of employers and the Ministry of Education together with technical college teachers took part in a small conference on National Certificates in Applied Physics which was held at the Institute's House on 20th September last. The assessors for the 1951 examinations, Mr. G. R. Noakes, Dr. J. Topping and Mr. G. W. Warren commented on the standard reached in the examinations. Papers were read by Dr. W. Hirst and Dr. Topping and were much appreciated; shortened versions of these two papers are printed below.

THE TRAINING OF ASSISTANTS IN A RESEARCH PHYSICAL LABORATORY

By Dr. W. Hirst, F.Inst.P.

In 1947 Associated Electrical Industries Limited set up a fundamental research laboratory in a rural area and as adequate numbers of suitably trained assistants were not available locally it was decided to start a training scheme following in broad principles the training courses for engineering apprentices already existing in other parts of the Company. A description of this scheme, specifically designed for the training of assistants in physics, may be of interest to teachers and industrialists. The scheme comprises training given by the Company and study at a branch of Reading Technical College opened to teach the National Certificate Courses (S. 1, S. 2, and S. 3) in Applied Physics; these classes are held on Company's premises at the laboratory. The teaching has been carried out by members of the laboratory staff, the senior teacher being directly responsible to the Principal of the College for the organization and administration of the course. The scheme of training by the Company is made flexible so that the natural aptitudes of the assistant and also his progress in the classes can be taken into account. Assistants obtaining the Ordinary National Certificate transfer to Northampton Polytechnic to take the courses leading to the Higher National Certificate examination. It is the Company's hope that in due course sufficiently gifted students will proceed further to take the new Graduateship examination of the Institute and ultimately achieve professional status.

In a research laboratory an assistant may be working as a personal assistant to a graduate, he may be serving as a maintenance engineer on a complicated piece of physical equipment, he may be carrying out experiments under supervision, or he may be concerned in the development of new equipment. If he is engaged in experimental work, it will usually change from time to time, apparatus will require modification, new apparatus will need to be built and it will be the exception rather than the rule for him to be engaged solely on the recording and writing up of experimental results. It is desirable therefore for the assistant to have some mechanical skill; there is often a considerable saving in time if the assistant is able to make minor modifications to apparatus for himself. Thus, whereas the duty of giving the trainee a theoretical background of knowledge against which he can understand what he is doing in his daytime work falls upon the Technical College, the employer can usefully supplement the rather limited workshop practice and drawing classes of the Applied Physics Course by giving additional training in workshop methods, apparatus construction and design, and in other laboratory arts. As later in his career the assistant may often be involved in discussion with skilled mechanics or draughtsmen his workshop course should include the teaching of the uses and also the limitations of the machine tools likely to be encountered in a good laboratory workshop.

Although the training scheme is flexible it usually comprises two main parts. In the first period, lasting from two to three years, the junior is given the basic training to enable him to become an assistant to a graduate. The usefulness of the assistant will increase as time goes by and after a further two or three years the graduate and assistant working together should be able to proceed at about twice the rate of the graduate working alone. This first period comprises full time day training in workshop practice and laboratory arts and also in a variety of laboratory techniques; at the end of it a boy will have obtained, or soon be about to obtain, the Ordinary National Certificate in Applied Physics.

A boy usually enters the Aldermaston laboratory as a junior laboratory assistant immediately on leaving school. A great deal of attention is paid to interviewing him before he joins and at the interview teachers from the Applied Physics Course are present. Unless he is capable of benefiting by the training in laboratory arts and also of gaining at least the Ordinary National Certificate his career prospects are limited and only those are taken on who are likely to complete this first stage satisfactorily. The interviewers, after satisfying themselves that the applicant is at least moderately interested in working with his hands and is keen to learn to use tools, have also found it profitable to go through a piece of physics with him. This part of the interview influences the decision whether the boy should begin the Applied Physics Course at the S. 1 or S. 2 stage. Experience has shown that it is unwise to exempt a boy from the first year of the course without good grounds for doing so; it is impossible to overlearn the elementary basic principles of physics, but great harm can result by too readily taking it for granted that these are adequately understood. The boy is also required to hold a good general certificate of education with a pass in English in addition to scientific subjects.

After appointment the boy is released for a full day per week to take the Applied Physics Course (this Course also involves some evening classes), the remainder of his time being devoted to training in laboratory and workshop methods. The first six months of this are spent in the workshops learning to use hand tools and later machine tools. The permanent members of the workshop are appointed as members of the laboratory staff and they are all chosen for their versatility; a great variety of types of equipment has to be made and it is seldom that more than one of a particular piece of apparatus is required. The workshop staff have shown as much interest in the training scheme as have the scientists and without their co-operation it would not have been possible to help the juniors to the same extent. Each boy is placed in the charge of a skilled laboratory mechanic and a boy may work with two or perhaps three men during his time in the workshops. Because of the variety of work the boy learns several times as rapidly as he would in a more normal apprenticeship at an engineering works; at the end of the six months, the boys, whilst by no means craftsmen, are, nevertheless, well grounded in workshop methods. In addition the boy also spends about three months' full time in the drawing office.

After the initial workshop training, the boy starts to learn other techniques. Usually he spends three monthly periods learning some or all of the following: vacuum practice, electronic wiring, glass-blowing—if he has any aptitude for it—and photography. These periods are interspersed with periods in the laboratories where he picks up various general laboratory techniques depending on the type of work in progress. During his migrations he becomes acquainted with the types of work in different parts of the laboratory and he usually finds something which has a particular appeal for him; at the same time the supervisor gets a good picture of his capabilities. After the preliminary two- to three-year period it is therefore possible to discuss his prospects with him and place him in a part of the laboratory where he is likely to do fairly well; his own views are given considerable weight. Before finally placing him, he may be given extra training in workshop practice or some other laboratory art for which he has shown special aptitude. Also, if an assistant seems unlikely to get beyond the Ordinary National Certificate level, it may be profitable to give him extra training to increase his manual skill.

Thus, by about the half-way stage in his training, the junior is able to begin to act as an assistant to the graduate physicist. The object of the second part of the apprenticeship is different from that of the first. A graduate working with an assistant has to break his problems down into parts which are within the capabilities of the assistant. The purpose of further training is to enable the assistant to take over at an earlier stage, i.e. at a higher level of work. At this point in the training, therefore, the emphasis shifts; the objective is to transform the capable manual assistant into a junior physicist. Assistants in a research laboratory have every opportunity in the normal course of work for learning specialized laboratory techniques and it is unnecessary for the Technical College to provide them with such training. It is better for such men to acquire a systematic knowledge of physics and mathematics so that they may appreciate the fundamental principles underlying their daytime work in the laboratory and can calculate, for example, the relative magnitudes of the factors influencing experimental results. The Higher National Certificate course should also provide a general course in modern instrumental methods so that the assistant when asked to devise a method of measuring a particular quantity will have a good idea of how to set about it. At the end of the second part of the training period a man having made reasonable progress in the classes should be capable of doing experimental work under supervision.

The assistant's progress in classes is noted when determining salaries and, during the training period in particular, the salary scales are designed to encourage a junior to continue his studies; successful passing of an examination leads to a salary increase immediately after the announcement of the examination results. This takes place independently of the normal annual increments (given on the boy's birthday) during the training period from the age of sixteen to twenty-one. In general, it is envisaged that three grades of assistant will be produced by the training scheme. (1) Assistants holding the Ordinary National Certificate and trained in workshop practice and a variety of laboratory arts. Quite a proportion of the assistants may find their level at about this stage, but there is, nevertheless, a useful career open to them. (2) Assistants holding the Higher National Certificate but who are unlikely to obtain higher academic qualifications. These men are capable of working more or less independently as members of a group. (3) Assistants able to proceed to take the Grad. Inst. P. examination and later obtain full professional membership of the Institute. In the course of time these people will presumably mature to become indistinguishable from graduate members of staff. There is nothing in the constitution of the Company preventing such men from reaching high positions and there are many examples of men having taken equivalent courses in electrical or mechanical engineering who have done so.

Ten second-rate men are no substitute for one first-class man.

J. B. CONANT

AIMS AND METHODS OF THE NATIONAL CERTIFICATE COURSES

By Dr. J. Topping, F.Inst.P.

It is perhaps salutary to look at the National Certificate scheme as a whole and ask the fundamental question: "What are we trying to do?" Quite simply our aim is two-fold; firstly, to help the students to acquire a knowledge of physics and of some of the applications of physics in industry, and secondly, in so doing we wish to help them to appreciate the scientific approach to a problem, how a physicist tackles the new and unknown, and how he expresses a scientific answer to a question. This second purpose is the more difficult to achieve; it cannot be enshrined in a syllabus but it must permeate all our teaching, and particularly the teaching of mathematics.

Turning to the mathematics first, here we wish to teach the basic techniques, not as we would teach them to the mathematical specialist, but through the practical and the concrete. Naturally we shall place emphasis on the particular techniques physicists use and so some branches of pure mathematics will inevitably be excluded. But we wish to do *more*, namely to show how mathematics is used in physics, how the physicist translates the fundamental assumptions, the laws of nature, into mathematical terms, and conversely, how a mathematical equation really means something which can be expressed in the language of physics.

Now there is no simple division of functions between the teacher of mathematics and the teacher of physics; co-operation between them is essential. But we shall expect the teacher of mathematics to teach the basic techniques using numerous applications, constantly applying the techniques to simple physical problems and so illuminating their value and power. The teacher of physics will also deal with these applications, and will devote due time and care to the mathematical formulation of physical principles and to the physical interpretation of the mathematical equations subsequently derived; otherwise the mathematical processes are a meaningless jumble which confuses and misleads.

In the ordinary National Certificate examinations in mathematics the standard attained is yet hardly good enough; the papers are rather too orthodox, testing as they should the simple techniques of algebra, trigonometry and the calculus, but with not enough emphasis on the formulation and interpretation of mathematical equations. Also, we seem to neglect one of the most valuable processes in theoretical physics—the various methods of approximation and successive approximation, which can be introduced at all levels in our mathematics teaching, even at the most elementary. Evaluation of a square root is a simple example. This can also be linked with valuable work on "errors of observation," which would be of great help in the physics classes for many students have little or no idea how to estimate the error in a result derived from measurements made in the laboratory. Important as the subject of statistics is, experience seems to show that it might well be left out at the ordinary (S. 3) stage, and more emphasis be placed on the handling of experimental data with simple considerations of scatter about the mean, all linked with work on approximations and errors. If this were done the more formal introduction to statistical methods in the A. 1 and A. 2 years would probably be better appreciated.

As to the courses as a whole, there are three points which seem worthy of special mention. Firstly, in some places the mathematics and physics are out of step; this is unavoidable and the physics teacher will always have to face the difficulty of having to solve some mathematical equations, when the students are not familiar with the normal methods of solution. It may be necessary in a few cases merely to state the solution with little or no discussion, but it would be very valuable if an unorthodox solution could be given showing the physicist's approach to such a problem; what we might call the "insight" or the "observational" method.

Secondly, those of us who have had experience of formulating syllabuses in applied physics know the difficulty of selection. Where does the subject begin, where does it stop? The division between pure and applied physics is very arbitrary, and the more one considers the ordinary National Certificate papers in physics and applied physics the more one wonders why we use the adjective. Much would be gained from teaching the content of our syllabuses in physics and "applied" physics as *one* subject, call it what you will. Not only is the present division artificial, but it may have a deleterious effect on the teaching of physics which should be constantly fertilized by using practical examples. Is our present method not rather like asking the mathematics teacher to separate out the pure parts of his subject and to teach them untainted? The union of pure and applied physics would help the teacher and stimulate the student. At the advanced level, however, the nature of the specialization is such perhaps as to justify the use of the term "applied," but even here "mixed" papers might be an improvement.

Thirdly, are our syllabuses overloaded, and are we attempting to deal with too many facts to the neglect of the understanding of principles? Time in evening courses in Technical Colleges is always so limited, that we constantly have to try to ensure that the important matters are dealt with and the inessentials left out. We shall perhaps disagree about the "inessentials," but there will be general agreement that the understanding of the principles of physics is what we desire rather than mere knowledge of facts. Knowledge there must be, of course; we can only teach the principles through the facts, but we should be careful not to overweight with facts and so conceal, or not reveal, the basic principles and concepts. These National Certificate students, who

already have some industrial experience of applied physics, do need to be guided into an understanding of classical and modern physics, and into an appreciation of the method of physics as well as its techniques.

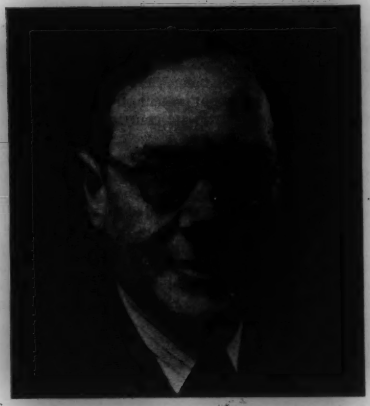
In case this seems a plea for something too profound, too theoretical, too difficult for these students, it might be said that basic principles as well as method may be taught through very elementary facts, and that no great mathematical equipment is necessary. Indeed the mathematical theory though important should occupy a secondary place. It is the phenomena which are primary, and insight into them the great gift which some physicists have pre-eminently. We probably cannot teach physical insight, but we can help the students to develop an appreciation of it by a clear exposition in non-mathematical terms of the physical ideas involved in the phenomena under discussion. Examples of how these ideas have been developed by outstanding physicists would also be helpful. Too often students do not realize that the mathematics only expresses the physical ideas which are the starting point of any theory. Difficulties which are often imagined to be mathematical are often due to lack of clarity in the physical picture. This underlines the importance of some of the earlier comments on the teaching of mathematics. Of course, physical ideas and concepts and theories should form a consistent whole. (What nonsense, alas, is sometimes written, for instance, about centrifugal force.)

In these National Certificate courses then one would like to see physics taught as a whole, using not necessarily the traditional sequence, but an unorthodox approach often through practical applications; further, one would welcome an emphasis on the expression in clear language of the basic physical ideas and secondarily on their mathematical formulation, whilst much could be done, linked with the mathematics courses, on errors and principles of measurement. Gaps in factual knowledge there will inevitably be, but these will be more easily filled later if the basic principles are understood.

DIARY OF INSTITUTE MEETINGS

Date 1951	*Place*	*Speakers*	*Title*	*Time*	*Branch or Group*
Nov. 14	**Edinburgh** The University	**Col. H. T. Jessop, F.Inst.P.**	Photoelasticity.	7.00 p.m.	Scottish
Nov. 16	**London** The Institute's House		The design of X-ray tubes. (Joint meeting with the Institute of X-ray Technology.)	6.30 p.m.	Industrial Radiology
Nov. 16	**Manchester** The University	**Mr. W. J. Meredith, F.Inst.P.**	Recent advances in the applications of physics to medicine.	7.00 p.m.	Manchester and District
Dec. 1	**Swansea** University College	**Dr. T. V. Starkey, F.Inst.P.**	Branch Annual General Meeting, followed by Administration and the physicist.	2.00 p.m.	South Wales
Dec. 6	**Newcastle-upon-Tyne** King's College	**Dr. B. P. Dudding, M.B.E., F.Inst.P.**	Forty years in industrial research.	6.15 p.m.	North-Eastern
Dec. 11	**London** The Institute's House	**Dr. G. F. J. Garlick, F.Inst.P.**	Recent research in electron and particle excited luminescence and its practical significance.	5.30 p.m.	Electronics
Dec. 11	**Glasgow** The University	**Prof. D. R. Hartree, F.Inst.P., F.R.S.**	Using an automatic calculating machine.	7.00 p.m.	Scottish
Dec. 12	**London** The Royal Institution	**Sir Robert Watson-Watt, C.B., F.Inst.P., F.R.S.**	The early days of radar.	5.30 p.m.	London and Home Counties
Dec. 12	**Edinburgh** The University	**Prof. D. R. Hartree, F.Inst.P., F.R.S.**	Using an automatic calculating machine.	7.00 p.m.	Scottish

MEMBERS OF NOTE



James Henry Awbery, M.A., B.Sc. (*Member of Board*). Born in 1899, Mr. Awbery went up to Cambridge in 1919 after two years' army service, and graduated in physics in 1921. In 1922 he joined the staff of the National Physical Laboratory where he remained for twenty years, most of his work being thermodynamics and calorimetry. From 1942 until the end of the war he was connected with "Tube Alloys," the atomic energy organization, and since 1946 has been in the technical policy section of the Ministry of Supply Division of Atomic Energy.

Mr. Awbery has given long service to the Institute and to various bodies concerned with disseminating physical knowledge. Elected to Fellowship of the Institute in 1930, he has served as a member of the Committee of the London and Home Counties Branch and from 1939 to 1943 sat on the Board as a representative of the Physical Society. He was elected again to the Board as an Ordinary Member in 1949. For twenty-one years he has been a member of the Council of the Physical Society.

Perhaps Mr. Awbery's greatest service to physicists has been through his connection with scientific publication. He was for nine years Honorary Papers Secretary of the Physical Society, for about twenty years a member of the Advisory Committee of the *Journal of Scientific Instruments* and has been a member of the Management Committee of *Science Abstracts* since 1932. He also represents the Institute on the National Committee for Physics.

James Sinclair Rankin, B.Sc., Ph.D., A.R.T.C. (*Chairman, Scottish Branch*). Professor Rankin, who is 57 years old, has been connected for most of his life with the Royal Technical College, Glasgow, first as a student and later as a member of staff. Graduating in 1915, he spent four years with industrial firms before being appointed to the College staff as chief assistant to the Professor of Natural Philosophy, whom he succeeded in 1942. From 1943 to 1945 Professor Rankin was given leave of absence from Glasgow to occupy temporarily the Chair of Theoretical Mechanics in the University of Istanbul.

The Natural Philosophy Department of the Royal Technical College has developed, under Professor Rankin's direction, a course of degree standard in applied physics and advanced work is being carried on in X-ray technology, electron microscopy, vacuum technology and other branches of applied physics. Professor Rankin's own earlier researches and publications were chiefly concerned with magnetostriction of steel.

Elected to Fellowship of the Institute in 1948, Professor Rankin became a member of the Board in 1950 when he was elected Chairman of the Scottish Branch. In 1948 he became Chairman of the Scottish Section of the Society of Instrument Technology. He is also a Member of the Institution of Mechanical Engineers.

NEW BOOKS

History of the Theories of Aether and Electricity, Vol. I. The Classical Theories. By Sir EDMUND WHITTAKER (London: Nelson and Sons Ltd.) Pp. 434. Price 32*s*. 6*d*. net.

Forty-one years have now passed since the publication by Professor Whittaker of *A History of the Theories of Aether and Electricity from the age of Descartes to the close of the Nineteenth Century*. The reviewer well remembers his pleasure in reading it when it appeared and how much he added to his knowledge of the historical development of physics from its pages.

In bringing the subject matter of a book of this kind up to date, Sir Edmund, in his retirement, has set himself the task of a reissue in two volumes, of which this is the first. This is fortunate, because to have eliminated much of the old material to find space for the new would have been a great pity.

Much of the new volume under the sub-title of "The Classical Theories" will be familiar to readers of the original though it is modified here and there in the earlier chapters and more so towards the end. Chapter 12, for instance, on classical radiation theory, hardly touched upon in the 1910 volume, is a natural addition and paves the way for the second volume, which we hope will soon appear.

To those of the present generation of physicists who are unfamiliar with the earlier work the reviewer would emphasize that this new volume is not a heavy treatise in theoretical physics, as perhaps its name might suggest. The first six chapters, for example, an historical account from Newton to Faraday, are rich in experimental fact, and contain few mathematical sections. Naturally the work of Maxwell and Lorentz demands a more mathematical approach, in which familiarity with vector notation is necessary; but even in these chapters the practically minded reader can still find interest between some parts that he may prefer to skip.

To the teacher wishing to interest his students in the historical background of optics and electricity there is much in this volume that he could directly incorporate in his lectures, and still more that students could be advised to read in their under-graduate years. The set-up of this volume is more attractive than the earlier one and if there are any mistakes or omissions in it, the reviewer was too immersed in the atmosphere of the book to notice them.

A. M. TYNDALL

Lucretius. The Nature of the Universe. A new translation by R. E. LATHAM. (London: The Penguin Classics, 1951.) Pp. 256. Price 2*s*. 6*d*.

Lucretius Carus, author of the great didactic poem De Natura Rerum, has a certain appeal to present-day physicists on account of his particular brand of common-sense philosophy. As a devout disciple of Epicurus, he inclines to the superficial. Yet he is not bound to the master's traditional tranquility. He is more the man of action.

The six books of the original divide naturally half-way; the first three culminate in man's mortality, whereas the rest are frankly "apologetics" for his materialism. By abandoning too rigid a regard for the grammatical structure of Lucretius, the translator has produced a most readable English text.

The poet was aware of the limitations of Latin for his purpose, a restriction which Mr. Latham has loosened with considerable skill.

F. I. G. RAWLINS

Report Writing. By C. G. GAWN, H. F. GRAVES and L. S. S. HOFFMAN. (London: Chapman and Hall, Ltd.) Pp. xv + 384. Price 35*s*.

Although one or two books on the presentation of technical information have appeared during the last few years it is still unusual to find a text-book on the subject. Indeed, although the report is often the only means of communicating the results of his work, the training of the scientist or engineer still gives very inadequate attention to the exposition of information. The preparation of reports is all too often regarded either as a rather minor matter for which training is unnecessary or as an art in which proficiency can be attained only by a gifted few. It is rarely thought of as a subject for separate study, either during or after the more usual technical training. In fact, most research workers and technicians quickly realize the advantages of being able to write good reports and many are able, by practice, to attain a reasonable standard. This book, a revised edition of one first published in 1929, sets out to provide a guide to such practice in the form of a course on report writing, complete with examples and exercises.

The book, by a Professor of engineering and two Professors of English composition, is written in an authoritative and satisfying style. The approach is by way of letter writing to a detailed treatment of the structure and composition of reports, particular emphasis being given to those intended for readers of limited technical knowledge. There are many examples, mostly from mechanical and civil engineering, of sections or paragraphs of reports and the last third of the book consists entirely of such examples. Although these are undoubtedly a useful feature, their extensive reproduction—mostly typewritten—does give the text a rather forbidding appearance on a first reading. Further, the examples reproduced in the first part of the book seem to be less useful than they might have been as, unlike those at the end, they are printed without an accompanying commentary.

Although definitely a text-book rather than a handbook, parts of the book should be useful for reference purposes, particularly the section on "The mechanics of letter writing," the chapter on "Requirements in style," and the lists, in an Appendix, of spelling forms (What is a muckbar?) and permissible abbreviations. Here, of course, allowance must be made for the American origin of the book, but even so, it is rather surprising to read in a list of journals that *Nature* is published monthly in New York!

The book is well produced but is definitely expensive. It can be recommended to the reader who wishes to improve the standard of his report writing but it does not, of course, offer a short cut to success in this field. This will be attained only by practice and it is here that this book will be of assistance.

A. E. DE BARR

The Neglect of Science. By F. E. SIMON, C.B.E., F.R.S. (Oxford: Basil Blackwell.) Pp. v + 138. Price 8*s*. 6*d*. net.

Most of these essays, addressed to laymen, first appeared in the *Financial Times* during 1948–50, and are here collected in book-form almost unchanged. They are written in the firm belief that our industry can only compete with that of other countries if it gives up its "traditional neglect of science," and there is a constant emphasis on the importance for us of the economical production and use of power. Atomic energy and other power sources of the future are discussed, but our immediate problem is coal.

Professor Simon's repeated plea is for a National Fuel Policy designed to make the best and most efficient use of our coal resources; he believes that "by a determined effort we could save about half of the present consumption, that is, about 100 million tons of coal per year." The open fire in the home must go and be replaced by a closed stove; it would be worth while for an enterprising Government to provide and install such stoves free of charge. (Will some political party adopt this at the next General Election?) There are other items in the plan, and we hope that many, scientists and politicians alike, will ponder his scientific approach to the problem. He is convinced, however, that there is little hope unless the scientist is not merely an adviser but has important administrative powers and functions, both in Government-controlled and private industry.

In the earlier articles of this book he considers the place of the scientist in industry and, drawing on his experiences in U.S.A. both during and since the war, he asserts that "It is to the great body of scientists and engineers, more than to any other group, that American industry and therefore America owes its present position of power." Elsewhere he reminds us how poorly industrial achievement in this country compares with the quality of our scientific research. He is led to discuss the education of technologists in this country, finding it inferior to that in Switzerland and the U.S.A. He is severely, and unduly, critical of the Technical Colleges in this country; he roundly states that we should build at least two Institutes of Technology on the Zurich or Massachusetts model, and that even *one* would set a new standard of technological education here.

Whether we agree or not, we can only welcome Professor Simon's clear and forthright writing and express the hope that this new publication will reach a wider public than his original articles.

J. TOPPING

The Human Use of Human Beings. By NORBERT WIENER. (London: Eyre and Spottiswoode Ltd.) Pp. 242. Price 18*s*.

This book is largely about the resemblances and differences between human beings and machines; and the dangers arising out of making machines too like human beings, or of treating human beings too like machines. The author ranges round the subject with a freedom reminiscent of a talk by James Stephens—successive index entries are Monkeys Paw (Jacobs), Monsters, Moral Values. The main subject is developed through a study of progress and entropy and learning, to language and communication; then by way of the industrial revolution to education and the future.

It is not a good book, but an exciting book. The logical structure of the author's thought is often concealed by the richness of his illustrations or the roughness of his treatment. At a few points the language is oddly refined, an allusion to "negatively phototropic fauna of the law courts" looks to the reviewer as if the phrase "lousy lawyers" had been edited away. At this stage the author has reached the controversial subject of patent law in the U.S.A. The book is avowedly written for Americans, and it deals severely and intimately with current American practice in education; it is most instructive for the reader to work out how much this section would have to be changed if English education were under discussion.

The book opens with a short section on cybernetics, but this is developed technically in another book and here is introduced to bring in the relationship between language and the general theory of communication. The author says, "Speech is the greatest interest and most distinctive achievement of man," which leads us to wonder what he really feels about man as an individual. His view of man is only partly stated in this book, but more of it is implicit in his sense of values; at various points he states, "The physical identity of an individual does not consist in the matter of which it is made . . . the biological individuality of an organism seems to lie in a certain continuity of process . . . the individuality of the body is that of a flame rather than that of a stone." This view of personal identity as pattern is vividly illustrated by a discovery made by plastic surgeons in Germany during the last war. When they re-cast a totally ruined face for a wounded man, they did not use photographs of the victim when young, but made it as close as possible to their idea of what a fighting man's face should be. If he recovered, and if he was not naturally the sort of man the surgeons would have wished, he slowly grew his features until he began to rebuild some resemblance to the man he used to be before the fighting. About religion the author does not say much, but he remarks that "The mental identity necessary for the Church's view of the individuality of the soul does not exist in any absolute sense which would be acceptable to the Church." This leaves us wondering how Wiener would interpret the doctrine of the Incarnation, which to many thinkers offers a more solid foundation for the valuation of individuals than does this rather ill-defined view of human identity in terms of process and communication.

Wiener's consideration of progress and its relation to entropy leads him to a rapid survey of the economic and social history of the industrial revolution, and its social consequences. He clearly diagnoses the inevitable catastrophe which results from our exploitation of unreplaceable natural resources, and clearly relates our collective recklessness to our neglect of the law of entropy. Oddly enough, he does not quote the work of Professor Soddy who expounded the fallacy of perpetual interest on capital by thermodynamic analogy. Discussing adaptability, Wiener says: "It is one of the paradoxes of the human race, and possibly its last paradox, that those who control the fortunes of the community should at the same time be wildly radical in matters that concern our own change of environment and rigidly conservative in the social matters that determine our adaptation to it." He then proceeds to discuss rigidity, and learning, and here the logical analysis needed for the development of computing machines finds its main application to human reactions. His views on the possible development of computing machines will be, to some readers, the climax of the book.

The book can be recommended to all members of the Education Group, to technical teachers of all kinds, and to anyone who does not mind feeling that he belongs in a minority. It contains sufficiently dynamic ideas to make it unsuitable reading for scientific civil servants, for orthodox Catholics and Marxists, or for anyone who still believes in the inevitability of progress.

E. VAN SOMEREN

Isaac Newton. By (the late) S. I. WAWILOW. (Berlin: Akademie Verlag.) Pp. 214, with 32 illustrations. Price 8.90 DM.

There is a good deal we do not know about the greatest of all the natural philosophers, both as to details of his life at some periods, and as to his character, including in that term an understanding of his way of thought, his reaction to publicity and to contradiction, and the impulses which directed him for long periods right away from investigations of natural phenomena.

Wawilow's book, written originally in Russian, and here translated into German, presents a coherent account of his life, divided into slightly artificial "periods," and, whilst discussing to some extent his scientific outlook, and particularly his attitude towards hypotheses in science, does not concern itself very much with Newton the man. Even in the account of his controversy with Leibnitz over priority in the invention of the calculus, the evidence from what we know of Newton's character is hardly considered at all.

As far as the reviewer's limited knowledge goes, Wawilow has taken account of all the latest work in the field, including Andrade's contribution on the origin of the verses at one time attributed to Newton. Nevertheless, the picture as a whole seems out of balance in that the reader is left with the impression that Newton's work on optical matters was a greater contribution than the work on mechanics. Admittedly, many were groping towards the ideas which he subsumed in the three laws of motion, and many towards an inverse square law for gravitation, but without him it must surely have been a long time before the whole theory was systematized and even longer before it was applied to hydrodynamics and the tides; in his hands, the fact that he dealt with all these together, and successfully, must have contributed to the acceptance of his ideas.

The book is well printed, and very fully illustrated; all the familiar portraits, authentic and otherwise, are reproduced. The translation is adequate, but it often betrays itself as translation, and should not be read by English students as an example of German style.

J. H. AWBERY

Science—Sense and Nonsense. By J. L. SYNGE. (London: Jonathan Cape.) Pp. 156. Price 8*s.* 6*d.*

The passages indicated in this review by quotation marks have been chosen from Prof. Synge's little book on the philosophy of science (which, in this case, really means physics) to give some idea of the style and line of thought of it.

"Thought is difficult and painful. The difficulties and pain are due to confusion. From time to time, with enormous intellectual effort, someone creates a little order—a little spot of light in the dark sea of confusion. At first we are all dazzled by the light because we are used to living in darkness. But when we regain our senses and examine the light we find that it comes from a farthing candle—the candle of commonsense." "We tread on dangerous ground when we insinuate that truth is reached by playing a game with rules comparable with the rules of chess" for "of no man can it be asserted that his knowledge of the rules of reasoning is complete." "In mathematics we say 'Let us for the time being play the logical game starting from this point and see what happens.' Clearly such a game cannot have any physical applications." In order to apply rules of logic to a phenomenon in the world of reality it is necessary to abstract from it a simplified core or structure. "The curious and powerful feat of abstraction, of withdrawing from the small object of ordinary life—the fly on the wall or the pebble on the beach—all its attributes save one (its position) was a feat that only the ancient Greek mind could accomplish. It was a feat not of logic but of imagination." "The Greeks did not possess the full clarity of modern mathematical thought, but they did look at things in a surprisingly modern way at times. Newton did not and he is in a sense more foreign to us than Archimedes is." ". . . Lord Keynes wrote . . . 'Newton came to be thought of as . . . a rationalist . . . I do not think that anyone who has pored over the contents of that box which he packed up when he finally left Cambridge . . . can see him like that. . . . He was the last of the magicians, the last of the Babylonians and Sumerians.'" "There are many British scientists, who if scratched, reveal themselves as Babylonians and Sumerians, not Greeks." "The prototype figures of Archimedes, Newton, and Francis Bacon do not tell the whole story of scientific motivation. There is a fourth. . . . If is the craftsman—the man with skills which it is his joy to use . . . for the joy of performance. Aesthete, mystic, practical man and craftsman —there he is, the scientist." "To reach the practical technical goal you must not dawdle; you must brush aside doubts. . . . The art of logical reasoning is quite a different affair. It is slow, for ever asking questions . . . its aim is . . . to make every yard of the road a piece of solid incontroversible rock." "You do not have to choose between one and the other, for life proceeds by compromise. . . . The essential thing for human dignity is that one should not be deceived regarding one's own intentions."

"Descartes described how he would go over and over the separate logical steps in a proposition until the whole thing appeared in his imagination as a single idea: only then did he claim to understand it." A similar process will probably be necessary for readers of this book. It is adorned with allegorical stories and conversations which the dust-cover claims are likely to become classical examples of exposition. They seem to me (for all that they are amusing) among the less successful parts of the book. The book is worth reading once for the pleasure to be got merely from reading it, and twice or more in order to find out what the author is driving at. But then one might begin to ask questions. For example, is not mathematics (and logic) an experimental science, derived in the last analysis from knowledge of the world of reality (from which we escape only by way of fairy tales and day-dreams), now so refined in its accuracy and subtlety of argument as to be barely understandable? Maybe an application of commonsense to the very foundations of some modern theories might help most of us to be less dazzled by the spots of light in the dark sea of confusion? But then an object of the book must be to suggest the asking of questions.

E. W. H. SELWYN

The Universe. By T. ROBINSON. (London: Ward, Lock and Co.) Pp. 254. Price 10*s.* 6*d.*

Although the style is a little sensational, and minor solecisms of grammar irritate one's pedantic feelings, this is a book to be read with enjoyment and to be recommended. Its shortcomings are those of the enthusiast, bursting to share good tidings; and all may be forgiven an author who can keep this up for 250 pages. Scientifically it is sound. About half the book is devoted to astronomy, and the accepted modern picture of the universe is well explained; school-boy readers would probably find it more helpful than the average popular account, since the most elementary matters which are usually taken for granted have not been overlooked. For the remainder dealing with earthquakes, volcanoes, geology, and prehistory, the reviewer was on less familiar ground, but was impressed by the care with which the author quotes his authorities and gives chapter and verse.

G. R. NOAKES

Science For All. Edited by J. T. HOGG, B.Sc., A.R.I.C. (London: Ward, Lock and Co., Ltd.) Fourth Edition, 1950. Pp. 255. Price 10*s.* 6*d.*

The publishers state that this is an authoritative volume designed to meet the needs of the large and ever-increasing class of readers who, while keenly interested in Natural Science, have neither the time nor the means to study and master the innumerable text-books, papers and reports necessary to an intelligent understanding of recent developments. The implications of this statement are interesting. Read carefully, it amounts to an unusually frank appraisal of the book, with which the reviewer heartily concurs; for the book itself will not help towards an intelligent understanding of recent work. There is also a sobering reflection on the reading habits of a section of the public which is keenly interested, but not to the immoderate extreme of marking, learning, and inwardly digesting. But perhaps these observations, like some sections of the book itself, were not really intended to be read very critically.

The book appears to be by more than one author. Some sections, notably those on botany and zoology, are adequately done, and the later chapters on the development of man and of civilizations are readable and well illustrated. It is surprising to find no mention at all of chemistry as a systematic study, since it must be very difficult indeed for anyone to grasp the concept of an atom without first understanding the rudiments of chemistry. Physics fares rather worse, for the short section of about forty pages devoted to this is far from authoritative and would have been better omitted altogether, as indeed it could have been without destroying the continuity of the rest of the book. Here too much has been attempted, necessarily in a superficial way, and the general effect is of an effort to impress rather than enlighten the reader. The physics section, in fact, makes it impossible to recommend the book for purposes of serious reading.

G. R. NOAKES

NEWS OF MEMBERS

Honorary Fellow

Sir Edward Appleton has been awarded the Sir Dabaprasad Sarbadhikary Gold Medal by the University of Calcutta.

Fellows

Sir James Chadwick has been awarded the Franklin Medal by the Franklin Institute, Philadelphia, U.S.A.

The following professional appointments have been notified:—

Professor J. P. Andrews—Principal-designate in the New Gold Coast College of Arts, Science and Technology.

Dr. C. M. Focken—Director of the Museum of Applied Science, Victoria, Australia.

D. W. Gillings—Head of Carbonisation Research, Central Research Establishment, National Coal Board, Stoke Orchard, Cheltenham.

M. R. Hopkins—Imperial Chemical Industries Research Fellow, University College, Swansea.

Dr. A. C. B. Lovell—Professor of Radio-astronomy, University of Manchester.

Professor J. Thomson—Deputy Director, Physics Research (C.V.D.), The Admiralty, London.

Sir Henry Tizard—Appointed by the President of the Board of Trade to be a member of the National Research Development Corporation.

Associates

M. C. K. Tweedie has been awarded a Leverhulme Research Fellowship.

The following professional appointments have been notified:—

D. S. Avery—Scientific Officer, Ministry of Supply, Telecommunications Research Establishment, Great Malvern.

D. S. Beard—Assistant to Technical Manager, National Research Development Corporation, London.

D. R. Goddard—Physicist, British American Research Ltd., Wishaw, Lanarkshire.

H. J. L. Herne—Physicist, Research Association of British Rubber Manufacturers, Croydon, Surrey.

C. A. Hogarth—Senior Scientific Officer, Ministry of Supply (T.R.E.), Malvern, Worcestershire.

H. V. Pilling—Head of Science Department, Schools of Technology, Oxford.

G. Stephenson—Imperial Chemical Industries Research Fellow, Physics Department, University College, London.

G. W. Walls—Senior Research Officer, Wool Research Laboratories, Commonwealth Scientific and Industrial Research Organisation, Geelong, Victoria, Australia.

Dr. W. Weinstein—Lecturer, Physics Department (Technical Optics Section), Imperial College, London.

Dr. N. N. Winogradoff—Senior Scientific Officer, Research and Development Branch, Ministry of Supply Factory, Windscale Works, Sheffield.

The world consists not only of electrons and radiations, but also of souls and aspirations. Beauty and holiness are as much aspects of nature as energy and matter.

J. C. SMUTS

THE REGISTER

ELECTIONS TO MEMBERSHIP

An asterisk (*) indicates transfer from another grade.

Fellows

*Darvell, William Gladstone, M.Sc., Head of Department of Pure and Applied Physics, Royal Technical College, Salford.
*Martin, Stanley Leonard, M.Sc., Head of Applied Physics Department, Melbourne Technical College, Australia.
*Pentland, Neil, M.Sc., Ph.D., Senior Lecturer in Physics, Acton Technical Collge, London.
Price, William Charles, Sc.D., Reader in Experimental Physics, King's College, London.
*Yarwood, John, M.Sc., Senior Lecturer in Physics, The Polytechnic, Regent Street, London.

Associates

Allan, David, B.Sc., Principal Science Master, Brechin High School, Angus.
Burnett, Raymond Edward, M.A., Principal, Marconi College, and Manager of the Education and Technical Personnel Department, Marconi Wireless Telegraph Co. Ltd., London.
Bunton, Marian Helen Hewson, B.Sc., Senior Physicist, Drayton Manor Grammar School, London.
Ewels, John, B.Sc., Ph.D., Research Student, University of Reading.
Gharpurey, Madhao Khanderao, M.Sc., Ph.D., Research Student, Applied Physical Chemistry Laboratory, Imperial College of Science and Technology, London.
Ginsborg, Bernard Lionel, B.Sc., Research Student, University of Reading.
Harling, William Francis, B.A., Assistant Master, Marlborough College, Wilts.
Hastewell, Leslie Jeffery, B.Sc., Research Student, King's College, Newcastle-upon-Tyne.
McAlister, Joan Margaret, B.Sc., Experimental Officer, National Physical Laboratory, Teddington.
Osmond, Walter Percivale, B.A., B.Sc., Research Physicist, Minnesota Mining and Manufacturing Co. Ltd., Slough, Bucks.
Rooum, John Miller, B.Sc., Assistant Lecturer in Physics, Technical College, Bradford.
Rowlands, William Eifion, B.Sc., Ph.D., Scientific Staff, Research Laboratories of the General Electric Co. Ltd., Wembley, Middlesex.
Williams, Leslie Wolton, B.Sc., Geophysicist, Department of Supply and Development, Melbourne, Australia.

Graduates

*Alcock, Kevin Maurice, B.Sc., Technical Officer, Amalgamated Wireless (Australasia) Ltd., Australia.
*Aldous, Graham Allan, B.Sc., Research Worker, British Scientific Instrument Research Association, London.
Bennett, John Albert, B.Sc.
Brotherton, Ian Dryhurst, B.Sc., Experimental Staff, Research Laboratories of the General Electric Co. Ltd., Wembley, Middlesex.
*Buchanan, John Scott, B.Sc., Research Student, University of Manchester.
Butlin, John Graham, Research Physicist, Ferodo Ltd., Stockport.
Cockram, John Crothers, B.Sc., Research Student, University of Melbourne, Australia.
Cooke, Ronald James, B.Sc., Assistant Physics Master, Howard Gardens High School, Cardiff.
*Crossley, George, B.Sc., Scientific Officer, Ministry of Supply, Malvern, Worcs.
*Dickson, Eric Winston, B.Sc., Assistant Experimental Officer, Royal Naval Scientific Service, Naval Construction Research Establishment, Rosyth.
*Duckworth, George, M.A., B.Sc., Research Physicist, Kelvin & Hughes Ltd., Barkingside.
Eales, Leonard William, B.Sc., Student Apprentice, General Electric Co. Ltd., Witton, Birmingham.
Earnshaw, Joseph Brian, B.Sc., Research Trainee, Metropolitan Vickers Electric Co. Ltd., Manchester.
*Gaffee, David Ian, B.Sc., Assistant Physicist, The British Oxygen Co. Ltd., Morden.
*Gay, Brain, B.Sc., Assistant, Joseph Crosfield & Sons Ltd., London.
Gill, Robert, B.Sc., Experimental Officer, General Electric Co. Ltd., Stanmore, Middlesex.
*Gray, Leonard Raymond, B.Sc., Assistant Experimental Officer, Admiralty Signals and Radar Establishment, Portsmouth.
*Harlow, Reginald George, B.Sc., Research Student, Woolwich Polytechnic, London.
*Hotson, Eric Stanley, B.Sc., Experimental Staff, Research Laboratories of the General Electric Co. Ltd., Wembley, Middlesex.
James, John Francis Pyne, B.Sc., Pyrometrist, Department of Supply, Defence Research Laboratories, Government of Australia.
*Johnston, George Murray, B.Sc., Research Physicist, Courtauld's Ltd., Coventry.
*Klemm, George Henry, B.Sc., Assistant Lecturer, Physiology Department, University of Queensland, Australia.
Kronheimer, Erwin Heinz, B.A., Research Student, University College, Southampton.
Mawson, Desmond Leonard, Head of Magnetic Research Department, Wm. Jessop & Sons Ltd., Sheffield.
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*Millard, Gerald Hilton, B.Sc., Engineer, British Broadcasting Corporation, London.
Niblett, George Bryan Francis, B.Sc., Scientific Officer, Ministry of Supply, Kent.
*O'Neill, Patrick Joseph, B.Sc., Technical Cadet, Amalgamated Wireless (Australasia) Ltd., Australia.
Rayner, Patrick, B.Sc., Technical Assistant, A. Gallenkamp & Co. Ltd., Dagenham, Essex.
Rollett, John Sydney, B.A., Research Student, University of Leeds.
*Samson, Joseph Ephraim, B.Sc., Technical Instructor, Foxboro-Yoxall Ltd., London.
*Scholefield, Peter Henry Romans, B.Sc., Scientific Officer, Signals Research and Development Establishment, Ministry of Supply, Yorkshire.
Showell, John Martin, B.Sc., Graduate Apprentice, Guest, Keen & Nettlefolds Ltd., Birmingham.
*Starling, Peter Philip, B.Sc., College Apprentice, Metropolitan Vickers Electrical Co. Ltd., Manchester.
*Tulett, Maurice William John, B.Sc., Assistant Chemist, Anglo-Iranian Oil Co. Ltd.
Turner, John Francis, B.Sc., Senior Scientific Officer, Ionospheric Prediction Service, Australia.
Waldron, Richard Arthur, B.A., Physicist, Marconi's Wireless Telegraph Co. Ltd., London.
*Walker, Paul Gordon, B.Sc., Research Officer, Commonwealth Scientific and Industrial Research Organization, Australia.
*Whitlock, Walter Sidney, B.Sc., Research Student, University of Durham.
Wilde, David Slater, B.Sc., Development Engineer, Ferranti Ltd., Manchester.
*Wright, Hubert Charles, B.Sc., Research Physicist, British Scientific Instrument Research Association, London.

Subscribers

Harrison, Reuel, Head of Science Department, Technical College, Gloucester.
Hartley, Henry Eric Rogerson, Chemical Inspectorate, Ministry of Supply.
Knight, Arnold Rogers, Technical Representative, Philips Electrical Co. Ltd., London.
Laurie, David Norman, Technical Assistant, Ilford Ltd., Essex.
Pugsley, Reginald John, Technical Engineer, Inspectorate of Armaments, Chorley, Lancs.
Rabley, Dennis Reginald Stuart, Lecturer in Mechanical Engineering, Plymouth and Devonport Technical College.
Robertson, John Henry, Research Assistant, Chemical Crystallography Department, University Museum, University of Oxford.
Tenny, Gerold H., Group Leader, Los Alamos Scientific Laboratory, University of California.
Vinter, Hans Christian, Director of Svejsecentralen, Copenhagen.

Students

Angus, R. K., University of St. Andrews.
Blackford, J. H., South-East London Technical College, Lewisham.
Davies, S., Exeter University College.
Gurney, J. D., Sir John Cass College, London.
Harcourt, A. M., Acton Technical College.
Holroyd, P., Bradford Technical College.
Joy, A. R., Northampton Polytechnic, London.
Levine, M., Acton Technical College.
McEntee, J. F. A., Royal Technical College, Salford.
Nailon, P. W., Bradford Technical College.
Tipping, F. R., Liverpool City College of Technology.
West, A. R., The Polytechnic, Regent Street, London.
Wignall, J. W. G., University of Melbourne, Australia.

APPOINTMENTS VACANT

The inclusion of particulars of a vacancy must not be taken to imply that the Institute necessarily approves of the terms offered or that might be offered. Candidates should satisfy themselves that these are satisfactory, and they may always refer to the Institute for advice.

Electronics: Specialist required with wide knowledge and practical experience for highly important development work in precision engineering establishment in Scotland. A unique opportunity is offered to scientist possessing initiative and vigour to develop original ideas. House available if required. Applications, stating age, experience, salary required, and when free, to **Barr and Stroud Limited**, Anniesland, Glasgow, W.3.

Physicist: Barr and Stroud Limited, Anniesland, Glasgow, W.3, have a vacancy for a young man, preferably a graduate. This is an excellent opportunity to do research work under expert guidance, as applied to industrial engineering problems. Salary commensurate with potential ability, which must be above average. Applicants should state age, qualifications, and salary expected.

Metallurgists and **Physicists** are invited by the **Ministry of Supply** to apply for an appointment in the Scientific Officer class as leader of the X-ray and Electron Microscope Group in the Metallurgy Division of the Royal Aircraft Establishment, South Farnborough, Hants. Candidates should have a 1st or 2nd class honours degree in Physics or Metallurgy or equivalent qualification with at least 3 years' post-graduate research experience. Experience of structure determinations at high temperatures is desirable but not essential. They must be at least 26 years of age for the S.S.O. grade, and 31 years for the P.S.O. grade. Salary will be assessed according to age, qualifications, and experience within the ranges: Principal Scientific Officer—£960 to £1,295, Senior Scientific Officer—£720 to £910. Rates for women somewhat lower. Posts are unestablished but carry benefits under F.S.S.U. Application forms may be obtained from Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London, W.C.2, quoting A285/51/A. Closing date November 30, 1951.

An **Assistant Lecturer Grade B** is required as soon as possible, to teach mainly physics up to B.Sc.(General) standard together with some mathematics to Inter B.Sc., standard. Approved research investigations would be encouraged. An honours degree in physics is essential, together with research or teaching experience. Salary according to Burnham agreement, viz. £450 × £25–£750 together with appropriate increments for degree and experience.

Application forms may be obtained from the Principal, **Gloucester Technical College**, Brunswick Road, Gloucester, to whom they should be returned not later than November 30th.

Chemical Engineer or **Physicist** required for large industrial organization to work as section leader in an established team engaged in major research project. Investigations will be related to heat transfer and fluid flow, including fluidized systems. Salary range £700 per annum upwards, depending upon training and experience. Particulars to Box No. A.V.18, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Applications are invited for the post of **Research Superintendent** of the **Linoleum Research Council.** Salary according to qualifications, but in the region of £1,250 initially. Work will be initially in or near London, but may later be centred in the North. Applicants should write, stating age, scientific qualifications and experience to The Secretary, Linoleum Research Council, Roxburghe House, 273 Regent Street, London, W.1.

Applications are invited for the **Chair of Applied Physics** in the **New South Wales University of Technology.**

The duties include the direction of research in collaboration with other Departments and with industry. Applicants should give full details of academic and industrial (preferably engineering) experience. Salary will be at the rate of £2,000 (Australian) per annum.

The appointee will be eligible, subject to medical examination, to contribute to the Superannuation Fund which will provide an annual pension of up to £845 (Australian) per annum.

A statement of conditions of appointment and further particulars may be obtained from The Agent General for New South Wales, 56 Strand, London, W.C.2, with whom applications should be lodged not later than November 30, 1951.

Assistant Radiographer required for routine and development work in Metallurgical Laboratory. Candidates should have had experience in ferrous and non-ferrous radiographic examination. Salary according to age and experience. Write full details, qualifications, experience, age, salary sought, to Personnel Manager, **de Havilland Propellers Limited,** Manor Road, Hatfield, Herts.

Young graduate is required for work on spectrographic analysis, including the development of new methods. A keen interest in the subject is essential, but previous experience is not necessary. Apply to the Staff Manager (Reference GBLC/140), Research Laboratories of **The General Electric Company Limited,** East Lane, North Wembley, Middlesex, giving age and record.

Physicist required as an investigator in Physics Department engaged on problems in metal physics. University degree essential. Previous experience in research or industry an advantage; upper age limit 30 years. The post carries superannuation. Application, stating salary required, to be sent to The Director of Research, **Aluminium Laboratories Limited,** Banbury, Oxon.

MEMBERS' ADVERTISEMENTS

A limited number of members' advertisements can be accepted. A nominal charge is made.

For sale. As new: *Metal Spectroscopy* by F. Twyman, 1951, 30/–; *Practical Spectroscopy* by Harrison, Lord and Loofburouw, 1948, 27/–; *Spectrochemical Analysis* by Ahrens, 1950, 33/–; *Reports on Progress in Physics*, Vol. XIV, 1951, 21/–. E. van Someren, 4 Churchfields, Broxbourne, Herts.

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